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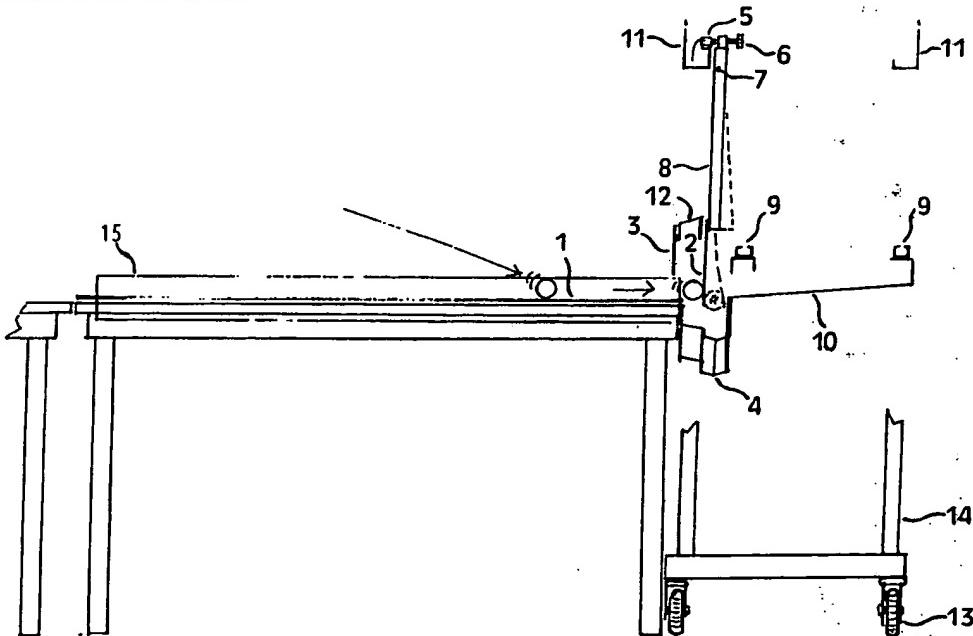
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(21) International Application Number: PCT/NO90/00036 (22) International Filing Date: 16 February 1990 (16.02.90) (30) Priority data: 890702 20 February 1989 (20.02.89) NO (71)(72) Applicant and Inventor: BLINDHEIM, Kristen, Jarle [NO/NO]; Blindheim, N-6230 Sykkylven (NO). (74) Agent: CURO AS; N-7094 Lundamo (NO). (81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.	Published <i>With international search report. In English translation (filed in Norwegian).</i>	

(54) Title: TABLE TENNIS ROBOT



(57) Abstract

A table tennis robot sends a ball towards a player, so as to simulate a realistic situation in a game, where the device comprises a firing unit, a receiving unit and a collection unit. A damping plate (1) is located on the table-tennis table, on the opposite side of the table from the player. The damping plate (1) slows and controls balls from the player. A trigger mechanism ensures that the player receives a return ball when the player hits a ball correctly. The device may embody more than one firing unit with associated trigger mechanisms, so that return balls come from the same area that the player has hit the ball to.

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Table tennis robot

The invention concerns a device comprising a table tennis robot that serves, collects and returns balls in accordance with the introduction to Claim 1.

5 Background for the invention.

Various types of training appliances are known in sport. Some of these simulate real competitive play, in other words an opponent. In the sport of table tennis, there are machines that automatically "feed" balls to a player.

10 US Patent 2 765 171 describes a device that sends table tennis balls that a player is to return, so that the balls are collected by a net behind the table. The balls that are returned to the player all come from the same point so this device does not give varied enough training. The same
15 problem applies to US 4 002 336 and US 4 116 438. These devices all require a large net to collect balls and do not have any form of damping tableplates. Furthermore, they do not follow the rules of table tennis, since a ball is
20 returned irrespective of where the player hits the previous ball. Most of known devices provide interval balls, i.e.
balls that are fired straight at the player. There is furthermore no known table tennis robot that provides what can be characterized as play. A further problem with known
25 robots is that they are noisy as a rule, and usually are stressing for the player because the tempo of play is too quick.

Purpose of the invention.

The main purpose of the present invention is to devise
30 a table tennis robot that gives a training situation that really provides a game.

An other objective with the present invention is to devise a table tennis robot that returns varied balls.

A further objective with the present invention is to devise a table tennis robot that returns balls from different positions as a response to shots from the player.

5 A further objective with the present invention is to devise a table tennis robot that returns balls after a serve from the player, or after a player has pressed an impulse switch.

10 A further objective with the present invention is to devise a table tennis robot that returns balls only after the player has hit the other side of the table.

A further objective with the present invention is to devise a table tennis robot that is almost silent.

15 A further objective with the present invention is to devise a table tennis robot that does not return more balls than the number the player returns.

Principles of the invention.

The main purpose of the present invention is met by a device as described in the characterizing part of Claim 1. 20 Other advantageous features of the invention are described in the subsidiary claims.

Description of the invention.

The invention will now be described in more detail with 25 reference to the accompanying drawings, where

fig. 1 shows a side perspective of a table tennis table where a version of the present invention is mounted,

fig. 2 shows a front perspective of the configuration in fig. 1,

30 fig. 3 shows the collection system in detail from the configuration in fig. 1,

fig. 4 shows a side perspective of the feed mechanism in detail from the configuration in fig. 3,

35 fig. 5 shows a front perspective of the feed mechanism in fig. 4,

fig. 6 shows a side perspective of a table tennis table as a second design of the present invention,

fig. 7 shows a front perspective of the design in fig. 6.

Reference is first made to fig. 1 and 2 especially, comprising a collection system, a damping coating or a damping plate 1 that covers the half of the table facing the player. At the edge of the table plate there are vertical damping plate 3, fitted in a profile 12. This plate 3 are to dampen top-spin balls, and help prevent a missed shot releasing the mechanism. There guide plates 15 on the sides. Immediately behind the table, at a distance that is at least the diameter of a ball, there are plates 2 that are connected to vertical pendulum frames 8. The pendulum frames 8 are hung from a mount 7, which they can swing around. The number of plates 2 with connected pendulum frames 8 can be varied, there are four in the example shown here. Each of the pendulum frames 8 is connected to its own microswitch 5, located on the top side of the axis of movement around mounting point 7, where the microswitches are mounted on the top cover of the collection unit. When a player hits a ball, the plate 1 will dampen the ball and control its bounce. The ball then travels horizontally towards the damping plate 2. The force of the ball starts the pendulum plate 8 to move around the axis of its mount 7. The microswitch 5 is activated by this movement through an adjustable screw 6. The microswitch 5 is connected to an automatic launcher, with feed, generally-termed 26 (Figs. 4-5) and a per se known firing mechanism. There are openings 17 between the pendulum frames 8 where the firing mechanism has space to shoot balls towards the player. U-shaped profiles are fitted between each of these. The firing unit is fitted on tracks 9 to provide a means of regulating the lateral direction. This firing robot provides a controlled return of the next ball. There should be at least two firing robots so that balls can be returned from the correct side. There can also be as many firing robots as receiver units (comprising plate 2, pendulum plate 8 with adjustable screw 6 and microswitch 5). If the player does not manage to hit the ball onto the opposing half of the table, there is no return ball from the robot as the pendulum plate 8 is not touched. Below the

receiver plate 2 there is an open tube 4, which has a fall towards each side with its highest point in the middle. When balls fall into this, they will roll to the outside point where they are sucked into a container by a fan arrangement 5 (Fig. 3). An under plate 10 returns balls to the player when there is a shot that does not land on the table, these also fall in the tube 4. Apart from the guide edge 15 and the plate 1, the collection system is mounted on a frame support 14 with wheels 13 so that it can be quickly fixed to the 10 table.

In addition to, possibly instead of the pendulum plate 8, photoelectric cells 5 can be used to register when the balls come and where they hit. This is a particular advantage with slow balls (slice shots), as the impetus of 15 the ball will be too slow to make the pendulum frames move. The photoelectric cells 5 can be positioned just above the surface of the table.

Fig. 3 shows the collection system in accordance with the present invention. Open tube 4 is connected at its end 20 to tube 21, that the balls are sucked into. Tube 21 has an internal diameter which is fairly close to the outer diameters of the balls, this ensures good suction. Tube 21 is connected at its other end to the suction chamber 16, which contains a motor 27, a fan 29 and a cap 28, all of 25 known design. The motor 27 for the fan 29 can be regulated and used to control the speed of the game. A coiled spring 23 is located inside the suction chamber 16 where tube 21 ends. Coiled spring 23 guides the balls through the chamber 16 and has a diameter that is a little larger than tube 21. 30 Coiled spring 23 ends in a tube connection 24, that guides the balls to another coiled spring 30. A ball in the space between the chamber 16 and the tube connection 24 will act as a valve until the next ball comes. From spring 30, the balls go into a feed unit 26 through a tube connection 25, 35 that is flexibly connected to chamber 16. The coiled spring 30 and the tube connection 25 mean that the feed unit 26 can be placed in different positions and at different angles.

Figs. 4 and 5 show the feed unit 26 in detail. This consists of a restraining spring 33, that keeps balls in place until an impulse on a microswitch 5 gives the message that a ball is to be fired. This impulse goes to a propulsion mechanism 5 31, and works by a spring piston, or similar, 32 striking the ball with enough force to release it from the restraining spring 33, so that the ball is fired. The propulsion mechanism 31 can be an electromagnet (piston or motor), air cylinder, or be another known system that is not 10 part of the invention. After the propulsion mechanism 31, a non-illustrated firing mechanism of known design can fire the balls towards the player.

Fig. 6 shows a simple playing machine that is designed along the same damping plate principle as shown in Fig. 1. 15 The damping plate 1 is identical, and the guide plate 15 is also used. Damping plate 2 has no fixing frame, but is attached to mount 12 which also serves the purpose of acting as a frame between the support 14 and the wheels 13. A cover 11 holds the damping plates 2. Reference is also made to 20 Fig. 7 where the collection tube 4 has a fall to one side. The player can adjust this fall to the side he/she wishes to get the return balls from. The frame 10 can be fitted to both sides. After the feed mechanism, the ball goes through a tube connection 24 to a chute 6 and rolls towards the 25 player who gets enough time to prepare a shot. Chute 6 can be adjusted in height as well as sideways. This design is particularly useful to train beginners in hitting straight returns. This is done by allowing balls from chute 6 be hit to plate 1, and damped between plates 1 and 2 and fall down 30 into the open tube 4. Then balls will roll along one side, be sucked up through the riser tube 21 by the motor 27 and the fan 29. The suction chamber 16 can be designed as in Fig. 3, but a simpler design is preferred. Tube 21 is connected diagonally to chamber 16, in the chamber there are 35 guide springs for the balls. At the bottom of the chamber, there is a tube connection 24 where a ball will hang suspended by the suction from the fan 29. When the next ball

comes, this will fall on the ball that is in connection 24, and force this to roll down chute 34, and stop in connection 24 itself. The system has two to three balls in circulation, depending on the tempo that is required. In addition, this
5 design has a return tube that can be used when a player wants training in serving. In this case the fan is stopped and there is an opening between tube 4 and the chute 36. This means that the player does not need to pick up balls, but gets them returned to the playing position.

Claims:

1. A device in connection with a table tennis robot, of a type that automatically, or as a result of an external impulse, sends a ball towards a player, so as to simulate a realistic situation in a game, where the device comprises a 5 firing unit, a receiving unit and a collection unit,
characterized by comprising
 - a damping plate (1) located on a table-tennis table, on the opposite side of the table from the player,
 - one or more receiving units, that each have a 10 receiving plate (2) for balls, located in an approximately vertical position behind the edge of the table, and
 - a suction unit (16) that transports balls from the receiving unit to the feed unit (26).
2. A device as claimed in Claim 1,
15 characterized by that below and behind the half of the table with the receiver/feed unit there is a tube (4) with a fall where the balls are collected before the suction unit (16) loads them into a container.
3. A device as claimed in Claims 1-2, where the suction 20 unit comprises
 - a fan (29) and a motor (27) that creates a pressure reduction in a chamber (16),
 - a tube (21) that is connected to tube (4) at one end, and chamber (16) at the other end, where the tube (21) has 25 an internal diameter which is approximately similar or larger than the outer diameter of a ball,
characterized by the suction unit also comprising
 - an initial spring (23) through the chamber (16) from the tube (21) to a first tube connection (24), where the first tube connection (24) is flexibly attached to the chamber (16), and is also attached to a feed mechanism (26), preferably by means of
 - a second spring (30) and a second connection (25).

4. A device as claimed in Claims 1-3,
characterized by it further comprising
- a rotating pendulum frame (8), which is connected to
- a trigger mechanism (5) for the feed (26).
5. A device as claimed in Claims 1-4,
characterized by the receiver units being
connected to a firing unit and that there are at least two
firing units so that the balls can be returned from the part
of the table where they landed.
- 10 6. A device as claimed in Claims 1-5,
characterized by the trigger mechanism
comprising a microswitch (5) that is released by means of an
adjustable screw (6) through the movement of the pendulum
frame (8).
- 15 7. A device as claimed in Claims 1-5,
characterized by the trigger mechanism
comprising a photo-electric cell (5) that registers that
balls arrive and where they arrive.
8. A device as claimed in Claims 1-7,
20 characterized by a damping plate (3) located
in front of the receiving plate (2).
9. A device as claimed in Claims 1-8,
characterized by it having a feed unit (26)
comprising
- 25 - an opening for balls through the second connection
(25)
- a coiled spring (33) located so as to hold balls in
place, and
- a propulsion mechanism (31).
- 30 10. A device as claimed in Claims 1-3,
characterized by a feed mechanism comprising a
chute (34) that is flexibly connected at its upper end close
to the suction mechanism and inclining towards the player's
half of the table, where the chute (34) has height
35 adjustment device (35).
11. A device as claimed in Claim 10,
characterized by it being able to get balls
from both sides of the table, by moving the feed mechanism,

and tipping the tube (4) so that the balls roll towards the side the feed mechanism is located at.

12. A device as claimed in Claim 1,
characterized by a chute (36) located so that
it inclines in the longitudinal direction of the table and
that is operative when the suction unit is not in use, where
the highest end of the chute (36) is connected to tube (4)
and the lowest end is in the vicinity of the player.

1/5

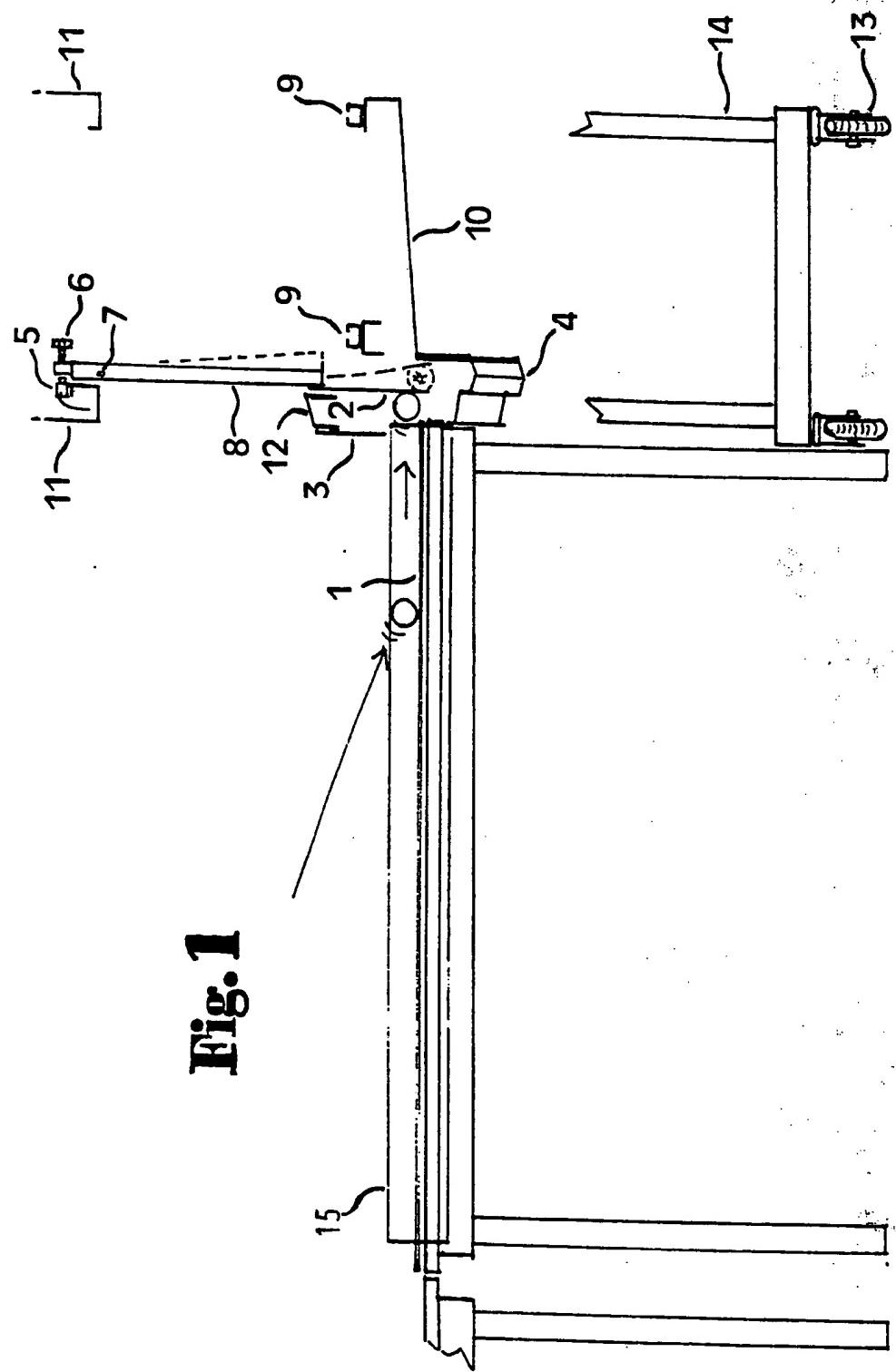


Fig. 1

SUBSTITUTE SHEET

2/5

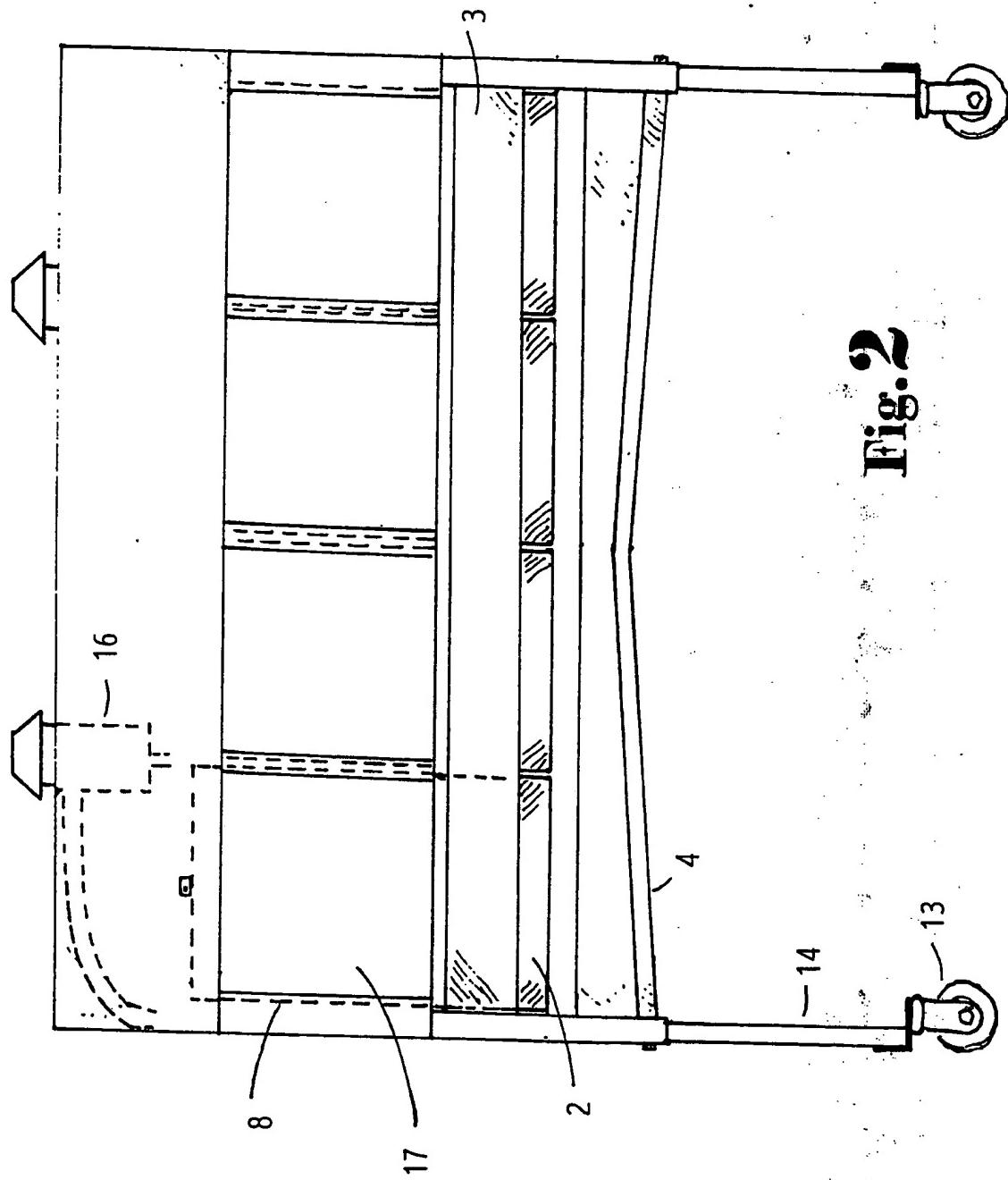


Fig. 2

3/5

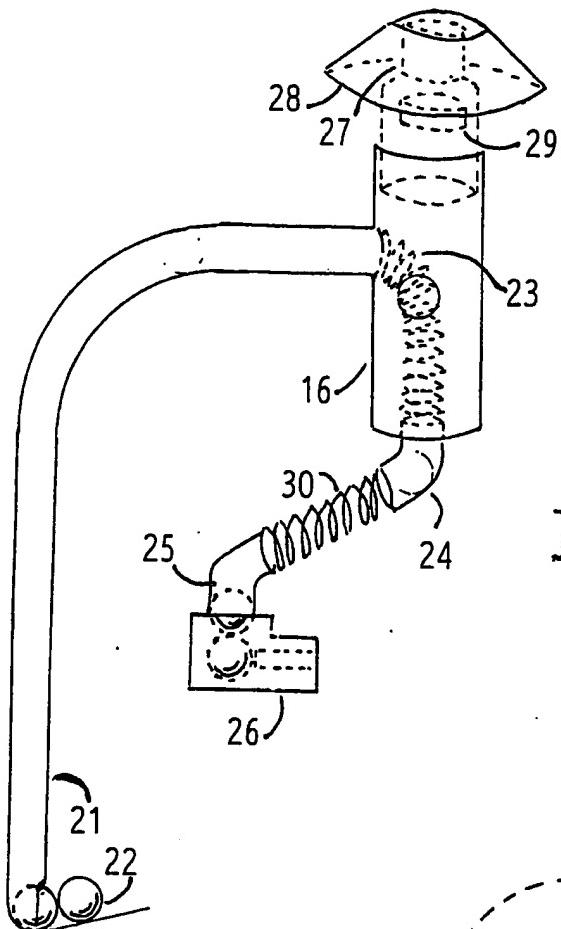


Fig. 3

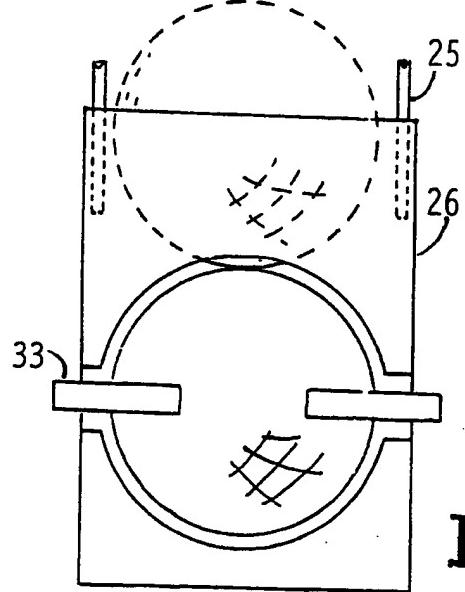


Fig 5

4/5

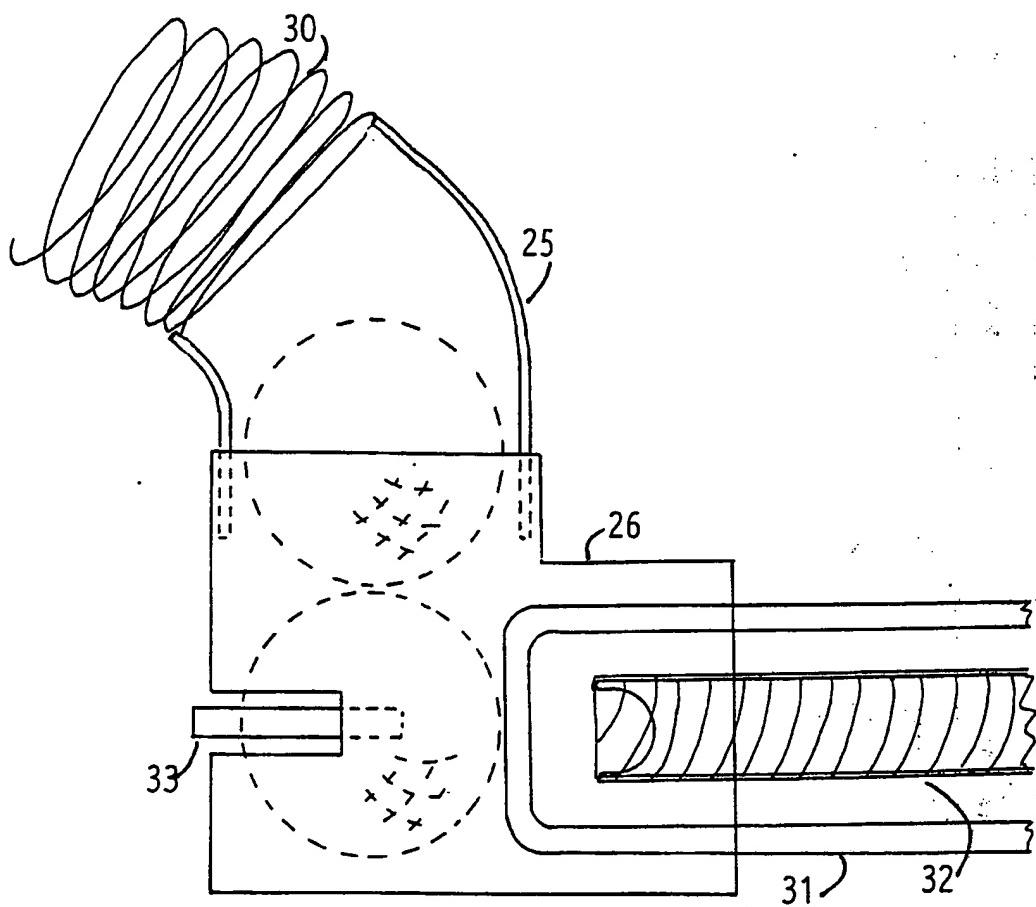


Fig. 4

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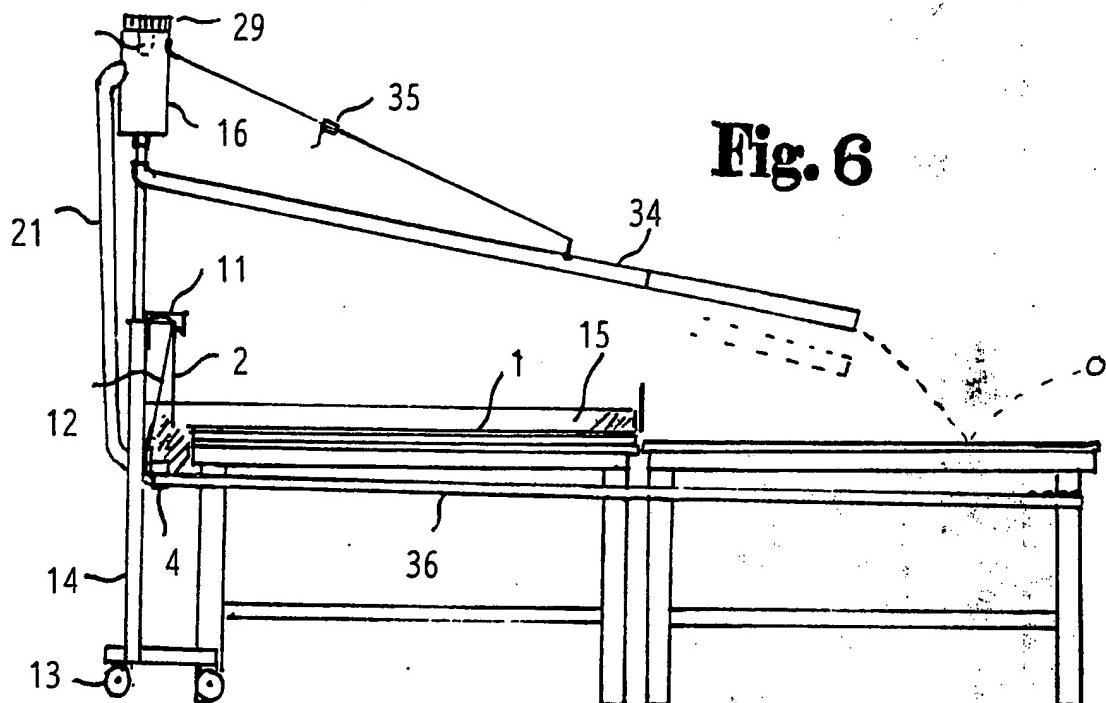


Fig. 6

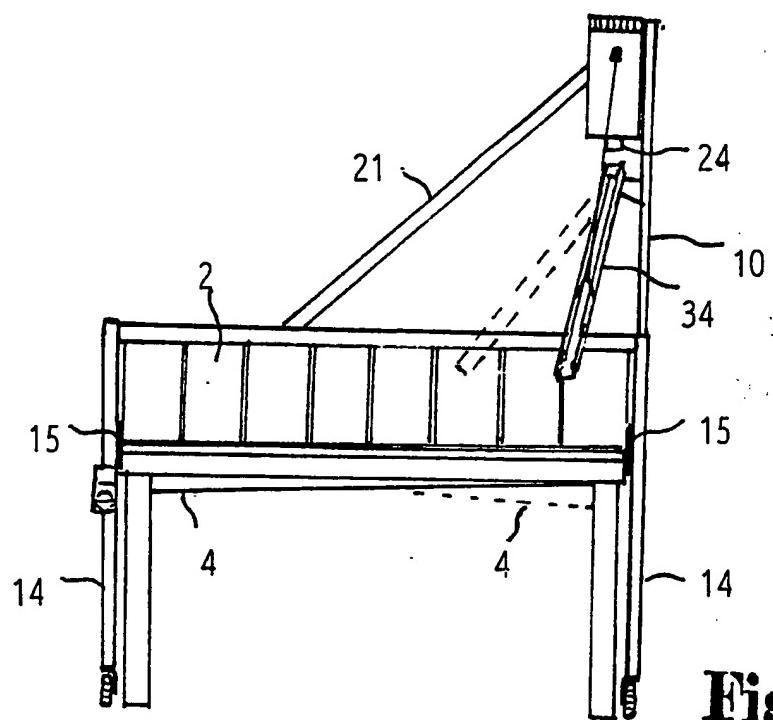


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 90/00036

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)⁵

According to International Patent Classification (IPC) or to both National Classification and IPC
IPC5: A 63 B 69/40

II. FIELDS SEARCHED

Minimum Documentation Searched⁷

Classification System	Classification Symbols
IPC5	A 63 B

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in Fields Searched⁸

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US, A, 2508461 (G. LEMON) 23 May 1950, see the whole document ---	
A	US, A, 4002336 (BEAVER ET AL) 11 January 1977, see the whole document ---	
A	FR, A, 1336688 (P.L. LEMARCHAND) 29 July 1963, see the whole document ---	
A	US, A, 4108432 (CLARK ET AL) 22 August 1978, see the whole document -----	

* Special categories of cited documents:¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the International filing date but later than the priority date claimed

"T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search 18th May 1990	Date of Mailing of this International Search Report 1990 -05- 21
International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer <i>Christer Bäcknert</i>

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/NO 90/00036**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on **90-05-07**.
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 2508461	50-05-23	NONE		
US-A- 4002336	77-01-11	NONE		
FR-A- 1336688	63-07-29	NONE		
US-A- 4108432	78-08-22	AU-B- JP-A- US-A-	499999 50054431 4046131	79-05-10 75-05-14 77-09-06